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ABSTRACT

According to Fiedler's Contingency Model of Leadership Effectiveness, group performance is a function of the leader-situation interaction. A review of past validations has found several problems associated with the model. Meta-analytic techniques were applied to the Contingency Model in order to assess the validation evidence quantitatively. The 33 tests used by Fiedler to derive the model and 127 subsequent tests of the model's validity were examined. Results of the meta-analytic computed on Fiedler's original studies indicated overall support for Fiedler's derivation. Analysis of Fiedler's 1978 review of the validation evidence for the Contingency Model found overall support for the model when field and laboratory studies were combined. Analysis of other direct tests not included in Fiedler's review also provided overall support for the model. Analyses of extension studies and investigations which examined the model in relation to training and co-acting groups indicated strong support for the model. The model was found to be an excellent predictor of group performance. The use of meta-analytic techniques appears to identify the directions that theory and research should take in the development of the Contingency Model. (NRB)

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A Meta-Analytic Investigation of Fiedler's Contingency Model of Leadership Effectiveness

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A Meta-Analytic Investigation of Fiedler's Contingency Model of Leadership Effectiveness[1]

According to Fiedler's Contingency Model of Leadership Effectiveness (1967), group performance is a function of the leader-situation interaction. The leader characteristic that is central to the model is leadership style or orientation as measured by the Least Preferred Co-worker scale (LPC). Leaders who score high on the scale (high LPC leaders) are viewed as being relationship-oriented, while leaders who score low on the scale (low LPC leaders) are viewed as task-oriented. Fiedler (1967, 1971, 1978) views control or influencability over the group as the important situational characteristic. The model, which was inductively derived, predicts that groups led by low LPC leaders perform best in situations of both high and low control. High LPC leaders have better performing groups in moderate control situations.[2]

Fiedler's model represents the first concerted attempt to apply Lewin's (1951) precept that behavior is a function of the person-situation interaction to leadership research, and has produced voluminous research in both the field and laboratory. However, the model has always been surrounded by controversy (e.g., Ashour, 1973; Graen, Alvares, Orris, & Martella, 1970; McMahon, 1972; Mitchell, Biglan, Onken, & Fiedler, 1970; Schriesheim & Kerr, 1977a&b; Shiflett, 1973). Of the various issues discussed in the literature, the question of the statistical validity of the model is the focus of this paper. It is our aim to review briefly past validations of the model (Fiedler, 1971, 1978), discuss problems associated with these validations and some alternatives, and finally present and use a meta-analytic solution (e.g., see Cooper, 1979; Rosenthal, 1978, 1979).

In the first major review of the Contingency Model (Fiedler, 1971), 25 studies which either tested or extended the model were examined. These studies,

all conducted after 1964, measured leader LPC and group performance, and used various methodologies for operationalizing situational control. Nine studies with interacting groups were analyzed; five laboratory (Chemers & Skrzypek, 1972; Fiedler, 1966; Fiedler exec 1967; Mitchell, 1969; Shima, 1968) and four field studies (Fiedler, O'Brien, & Ilgen, 1969; Hill, 1969; Hunt, 1967; O'Brien, Fiedler, & Hewett, 1969). Six additional studies (Anderson, 1966; Fiedler & Barron, 1967; Lawrence & Lorsch, 1967; Nealy & Blood, 1968; Nealy & Owen, 1970; O'Brien, 1969), not directly classifiable into one of the eight situational control octants were also included.[3] These "extension" studies (Fiedler, 1971) were instead classified into the general categories of high, moderate, and low situational control. Separately treated were studies of coacting (Bates, 1966; Hill, 1969; Hunt, 1967; McNamara, 1967) and training groups (Fiedler & Hutchins, 1967; Reilly, 1968; Seifert, 1971).

In Fiedler's review of direct tests of the model, binomial tests were used to assess the number of correlations in the predicted direction (Fiedler, 1967). Results indicated support for field ($p < .05$), laboratory ($p < .05$), and all studies combined ($p < .01$). The results for extension, coacting, and training studies were analyzed individually and in a qualitative manner, in which support for the model was claimed.

In his 1978 review, Fiedler added three laboratory studies (Rice & Chemers, 1973; Sashkin, 1972; Schneier, 1978) and one field study (Tumes, 1972) that directly tested the model. As with the 1971 review, a binomial test of the pattern of correlations was computed, with results indicating support for all studies combined ($p < .01$). Three additional analyses were conducted. The percentage of correlations in the predicted direction was found to be 81%. The rank-order correlation between the median within-octant correlations from the original studies (Fiedler, 1967) and the corresponding median within-octant correlations from the

validation studies indicated strong support for all studies combined ($p < .05$), field studies ($p < .05$), and the Chemers and Skrzypek (1972; the first full test of the model) study ($p < .01$). Finally, the squared median correlations were computed resulting in an estimate of the proportion of variance accounted for in each octant. Results indicated strong support in octants I, IV, V, and VIII; moderate support in octant III; and scant support in octants II, VI, and VII.

Analysis of the extension studies revealed a highly significant binomial test in support of the model, with the percentage of median correlations in the predicted direction being 74%. Also reviewed were a series of studies (Hardy, 1971, 1975; Hardy, Sack, & Harpine, 1973) which tested the model using an analysis of variance approach. Since this approach deviated from the traditional method of computing LPC-group performance correlations a separate qualitative analysis was performed in which support for the model was claimed. No studies with coacting and training groups were treated in a quantitative manner, although one training study (Chemers, Rice, Sundstrom, & Butler, 1975) was examined extensively in a separate section.

Combining Fiedler's reviews (1971, 1978) one finds the validation evidence lends considerable support for the model. However, considerable debate has been raised concerning Fiedler's methods for demonstrating this support. Foremost among these criticisms has been the use of the binomial test as an adequate assessment of the validity of the model (Ashour, 1973; Graen et. al., 1970; Mitchell et. al., 1970). Central to these criticisms is the fact that the binomial test is sensitive only to the sign of correlations and not their magnitude. As Ashour points out, small correlations can demonstrate an effect even if none of them is significant. In fact, only six of the 47 correlations between leader LPC and group performance (in the 1978 review) were significant. Moreover, the

binomial test would not be sensitive to the case where a relatively small number of highly significant results disconfirmed the hypothesis relative to many non-significant results in the predicted direction.

Several alternative approaches have been suggested, but they too have been frought with difficulties. For examples, Ashour (1973), Graen et. al. (1970), and Mitchell et. al. (1970) have recommended the testing of the obtained octant correlations against the median correlations from the antecedent studies (Fiedler, 1967). However, Mitchell et. al. are quick to point out that point predictions based on unstable results may be uninterpretable, and that a test of the null hypothesis ($\underline{r} = o$) is equally advisable.

In a review by Graen et. al. which found no support for the Contingency Model an analysis of variance approach was used with correlations as data points. However, there are several problems with this technique as presented by Graen et. al. First, for small $\underline{n}$, the Fisher transformation is not entirely appropriate for Spearman correlations (cf. Kendall, 1975). Second, the $\underline{n}$ on which the $\underline{r}$'s is based is not taken into account, thus ignoring the significance level of individual correlations. Finally, ignoring the individual sample sizes assumes the $\underline{r}$'s are equally stable, a questionable assumption.

Another strategy called the "batting average," was used in Rice's review (1978) which found support for the model. The batting average of a relationship between two variables is equal to the percentage of significant results in the predicted direction. It can be used without regard to the types of test statistics used. This technique provides a rough estimate of the pattern of results, but by ignoring exact significance levels it is somewhat imprecise.

Taken together, the above procedures represent only partial solutions to the problem of adequately testing the statistical validity of the Contingency Model.

What is needed is a technique that accounts for exact significance levels, in addition to directionality and number of results. The solution advocated in the present paper is meta-analysis (e.g., Rosenthal, 1978, 1979). These techniques, varying in complexity and sensitivity, allow the reviewer to determine the exact probability of a set of results given specific hypotheses. Moreover, the exact probabilities from various statistical procedures (e.g., r's, F's) can be conveniently combined. In summary, meta-analytic techniques allow a quantitative assessment of how well a given set of results fit the predictions of a theory. The application of these techniques to the research testing the Contingency Model is exemplified by the following analysis.

Method

Tests of the Contingency Hypothesis

A review of the literature was undertaken using the Psychological Abstracts, Social Science Citation Index, and previous reviews as the main reference sources. The sample included the 33 tests that Fiedler (1967) used to derive the Contingency Model, and 127 subsequent tests of the validity of that model.[4] A test is defined as any statistical analysis within any of the eight octants; or in the case of extension studies, within one of the three zones of situational control. Thus, a study may contain more than one test.[5]

The hypothesis tested reflects the predicted within-octant (in the case of extension studies, zones) direction of the relationship between leader LPC and group performance based on Fiedler's (1967) formulation of the model. Specifically, the relationship between leader LPC and group performance is predicted to be positive in octants IV, V, VI, and VII; and negative in octants I, II, III, and VIII (see Footnote 3). It should be noted that the original studies contained no information for octant VI, however, the theoretical formulation predicts a positive relationship.

For the extension studies, the zones of high and low situational control are associated with negative relationships, while the moderate control zone is associated with a positive relationship.

Procedure

The meta-analytic techniques used in the present study have been described in detail elsewhere (e.g., see Rosenthal, 1978, 1979). The present review will report results based on Stouffer's formula (Mosteller & Bush, 1954). In addition, tests of the mean p (Edgington, 1972b); tests of the mean $\bar{z}$ (Mosteller & Bush, 1954); Fisher's method (1938); and a method based on adding probabilities (Edgington, 1972a) were computed where appropriate in order to assess the stability of the results. Because there was high agreement among all methods, and because Stouffer's technique was applicable to all results, only the latter will be presented.

For each test of the hypothesis, the exact one-tailed probability was transformed into a $\bar{z}$ score. For results in the predicted direction, a positive $\bar{z}$ and a $p < .50$ were recorded. A negative $\bar{z}$ and a $p > .50$ were recorded for results in opposition to the hypothesis. The obtained $\bar{z}$'s and p's for the studies used in the analysis can be found in Tables 1, 2, and 3.

Insert Tables 1, 2, and 3 about here

The obtained $\bar{z}$'s were combined using Stouffer's formula, as follows: $\bar{z}_s = (\sum_{i=1}^{n} z_i)/ N^{\frac{1}{2}}$, where $\sum_{i=1}^{n} \bar{z}_i$ is the sum of individual $\bar{z}$ scores and N is the number of tests combined. The resulting $\bar{z}_s$ can be transformed back into a probability that represents the likelihood that the combined results occurred by chance. A number of combinatory strategies (detailed in the Results section) were used to test various aspects of the model.

In addition, an algebraic manipulation of Stouffer's formula provides an estimate of the number of new, unpublished, or unrecovered hypothesis tests averaging null results that would be required to bring the overall probability to a desired level (e.g., $p = .05$). This value, known as the "fail-safe" N (N_{fs}) (Cooper, 1979), is useful in that it allows the assessment of the strength of the meta-analysis results in relation to the felt completeness of the review, and in terms of the number of hypothesis tests already conducted. The formula takes the following form for overall $p = .05$ (i.e., just significant):
$N_{fs} = (\sum_{i=1}^{n} Z_i / 1.645)^2 - N$. This number was computed along with Z_s for all results.

Results

Original Studies

Several classifications of the data were made so that a number of temporal and categorical representations of the model could be examined. Of initial interest are the results of the meta-analysis computed on the original studies used by Fiedler (1967) to derive the model. Results indicated overall support for Fiedler's derivation ($N = 33$ results, $p = 6.44 \times 10^{-12}$, $N_{fs} = 526$), with all but octants III and VII receiving support (all p's $< .05$ and N_{fs}'s ≥ 10). Octant VI contained no studies.

Fiedler's 1978 Review - Octant-Bound Studies

The next classification was based on Fiedler's 1978 review of the validation evidence for the Contingency Model. This classification was further subdivided into hypothesis tests resulting from field and laboratory experiments. Overall support was found when field and laboratory studies were combined ($N = 47$, $p = 6.49 \times 10^{-7}$, $N_{fs} = 360$). However, only octants I ($p = 3.02 \times 10^{-4}$) and IV ($p = 1.39 \times 10^{-5}$) were supported at an acceptable level of significance.

When analyzed separately, both field (N = 21, p = 6.87 x 10^{-4}, N_{fs} = 58) and laboratory studies (N = 26, p = .00159, N_{fs} = 58) confirmed the model's predictions. However, only the results in octant IV (p = .00126) were supported in the laboratory studies, while both octants I (p = 4.83 x 10^{-4}) and IV (p = .00164) corroborated the model in the field studies. Table 4 presents the within-octant results for the above classifications.

Insert Table 4 about here

Additions to Fiedler's 1978 Review

A number of direct tests were not included in Fiedler's (1978) quantitative review for a variety of reasons (e.g., poor methodology, varying statistical procedure, oversight). An analysis of these results found overall support for the model (N = 34, p = 5.19 x 10^{-4}, N_{fs} = 101), as well as within octants IV (p = .0409), V (p = .0475), VI (p = .0107), and VII (p = .0102). When these results are added to those from Fiedler's 1978 review, the statistical support for the model is increased (N = 81, p = 3.10 x 10^{-9}, N_{fs} = 929). All but octants II, III, and V, received strong support (p's < .05). Table 5 contains these additional studies and the combined results for all octant-bound validation studies.

Insert Table 5 about here

Training and Coacting Studies

Several investigations have examined the Contingency Model in relation to training and coacting groups. While these studies have not examined octants II and IV, the obtained overall results for the remaining octants support the

model's predictions (N = 21, p = .00256, N_{fs} = 40). Individual support was found in octants V, VI, VII, and VIII (all p's < .05). Table 6 contains the relevant within-octant results. When these tests are combined with the previous findings, the results again indicate strong support for the model (N = 102, p = 5.59×10^{-11}, N_{fs} = 1466) with all but octants II and III supported (all p's < .05, see Table 7). This represents the combined results for all octant-bound hypothesis tests, both validation and training and coacting studies.

Insert Tables 6 and 7 about here

Extension Studies

A number of studies included in the Fielder 1978 review were not classified into octants but were instead classified into one of three categories along the situational control dimension (low, moderate, high). Combined, these hypothesis tests corroborate the other validation evidence (N = 25, p = 3.04×10^{-5}, N_{fs} = 124). This was also true within the three categories of low (p = .0307), moderate (p = .00307), and high (p = .00990) situational control (see Table 8).

Insert Table 8 about here

Finally, when all the evidence is considered, the results become even more striking. All hypothesis tests combined results in a p = 2.02×10^{-14} (z = 7.56) with N_{fs} = 2555 (N = 127 total hypothesis tests).

Discussion

Summary of Results and Comparison to Earlier Reviews

The results of the present investigation are quite impressive when compared

to the more selective reviews of past authors. For example, Fiedler (1971, 1978), presents relatively weak support for the model based on various subsets of studies. Further, there have been no tests of the model's validity at the level of specific octants. The present investigation circumvented both problems by including all recoverable tests of the model, and examining the pattern of results within each octant. The model as a whole was overwhelmingly supported. Equally important, all but octants II and III were consistent with predictions.

The failure to find support in octants II and III may be due to a variety of reasons. Perhaps these conditions are difficult to produce in experimental settings. Octant II, for example, seems unlikely to occur in stable groups, but may be characteristic of groups with emergent leaders where high group atmosphere, high task structure, but low position power are possible.[6] The lack of support in octant III was in large part due to the results from training and coacting groups, which were opposite to predictions (see Table 6). The model was originally derived for interacting groups, and thus inclusion of these studies in the overall analysis may not be appropriate. However, we chose to include these results to test the generality of the model. Indeed, the addition of these studies increased the statistical significance of the overall results.

The present investigation also allowed combination of a number of studies, either treated separately or ignored by Fiedler (1978) (e.g., the Hardy studies, Graen et. al. 1970). Taken together, these studies also confirmed the model overall, although the within-octant pattern differed. Whereas Fiedler's results indicated significant findings in octants I and IV, the additional studies substantiated the model in octants IV, VI, and VII. The combination of these additional studies with Fiedler's results (made possible by using meta-analysis)

indicated increased overall and within-octant support.

Results of this review should lay to rest many questions surrounding the statistical validity of the Contingency Model (e.g. Ashour, 1973; Graen et. al., 1970; Mitchell et. al., 1970; Schriesheim & Kerr, 1977). From a statistical standpoint there is no doubt that the model's predictions are confirmed. Moreover, as indicated by the obtained fail-safe N (N_{fs} = 2,555), it would take a substantial number of null results (mean p = .5) to bring the overall probability to the "just significant" level (i.e. p = .05), let alone disconfirm the model. Given that it took 13 years to generate the present validation evidence consisting of 127 hypothesis tests, it is unlikely that disconfirmation of the model is foreseeable in the near future.

Several additional concerns should be mentioned. While the present study demonstrated statistical validity, previous methodological criticisms of individual studies (e.g., Fiedler, 1971, Graen et. al., 1971a,b) are still justified. It is not our purpose to duplicate or add to past efforts at clarifying the results of individual studies. However, it is of major importance to identify systematic sources of bias in groups of studies. For example, a meta-analysis can be invalidated by lack of independence between hypothesis tests which can arise in a variety of ways (Cooper, 1979). At least three potential sources of non-independence are present in the Contingency Model literature. First, treating multiple dependent variables from the same subjects as separate hypothesis tests produces non-independence. This source of bias existed in the validation evidence presented by Fiedler (1971, 1978) and Graen et. al. (1970), but was avoided in the present review by the procedure of averaging results from multiple dependent measures from the same subjects. Second, bias can exist when a number of studies are conducted by the same research group. This source of bias can

be quite difficult to detect since it can occur in several ways (e.g., idiosynchratic methodology, regional subject samples, etc.). In order to test the possibility that the model is supported predominantly by studies conducted by Fiedler and his associates,[7] a t test was computed on the mean $\bar{z}$ score for results obtained by Fiedler et. al. (M = .659) versus results obtained by independent researchers (M = .684). The obtained t (125) = .11, n.s. indicates that studies conducted by researchers affiliated with Fiedler, and those conducted by independent researchers, did not significantly differ in support of the model, thus rendering this source of non-independence less plausible. Finally, a bias can exist at the level of the review where selection of studies may reflect some systematic and/or subjective criteria. Also, traditional literature reviews rely heavily on subjective conclusions. By contrast, this review included all recoverable studies and drew conclusions based on objective statistical evidence.

Implication and New Directions

The use of meta-analytic techniques, through increased quantitative and qualitative precision, also aids in pointing out several directions theory and research should take in the development of the Contingency Model. For example, given the previously mentioned reasons associated with the lack of support for octants II and III, the results for the non-octant-bound extension studies suggest some interesting alternatives for operationalizing situational control. We feel that the study of situational control is promising both in itself and as an adjunct to the Contingency Model. More intensive investigations of situational control may reveal alternative explanations for the failure of octants II and III to confirm the model. More importantly, increased knowledge of situational control should contribute to a greater understanding of leadership processes.

The study of training and coacting groups provides another interesting avenue of inquiry. Due to the small number of studies conducted with training and coacting groups, these results were combined in the present review. However, these results are characterized by two distinct processes which need to be studied separately in the future. For example, the results in octant III are primarily due to training groups producing results contradicting the model, while the results in octant V which confirm the model are primarily due to coacting groups. Only future research will shed light on the reasons for this discrepency. In addition to the overall lack of research, is the relative concentration of research in only a few octants (i.e., I, III, and V). This highlights the need to study leadership effectiveness with training and coacting groups across the range of situation control.

Finally, it is of interest to note that the model is comparably supported in both field and lab settings. This should be of importance to practitioners who are concerned with the applicability of the model to real world settings. Recent efforts by Fiedler and others to develop (Fiedler, Chemers, and Mahar, 1976) and validate (see Fiedler, 1978 for a review) a training program based on the model are noteworthy. Although much work remains, this represents a fine example of the development, extension, and application of a theory.

In summary, this review provided a precise appraisal of the status of the Contingency Model of Leadership Effectiveness. The model was found to be alive and quite well. Hopefully, new research will be directed towards areas of refinement and exploration and concern itself less with the issue of statistical validity.

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Footnotes

[1]Portions of this article were previously presented at the annual meeting of the American Psychological Association, Montreal, 1980.

[2]For a more extensive description of the Contingency Model, the reader should consult Fiedler (1972) and Graen et. al. (1970) Psychological Bulletin articles as well as Fiedler's (1978) comprehensive review.

[3]Fiedler defines situational control as composed of three factors: group atmosphere, task structure, and leader position power, ordered in terms of importance. Dichotomizing each factor results in eight possible combinations or octants. The octants are numbered in the following manner from high to low situational control:

Group Atmosphere	High				Low			
Task Structure	High		Low		High		Low	
Position Power	High	Low	High	Low	High	Low	High	Low
Octant	I	II	III	IV	V	VI	VII	VIII

[4]Two studies (Johnson & Ryan, 1970; Reavis & Derlega, 1976) which purported to test the Contingency Model were not included in this analysis because leadership style was treated as a manipulated independent variable. This clearly violates Fiedler's (1967, 1978) assumption that leadership style is a relatively stable personality trait. In addition, a laboratory study by Vecchio (1977) which also claimed to test the model was not included in the present review. Vecchio's method of assigning subjects to groups was not consistent with Fiedler's (1978) concept of group atmosphere. In Vecchio's study, all leaders were required to have at least one "unfavorably ranked classmate" in the three-member work group.

[5]Strictly speaking, a meta-analysis assumes independence of the results

to be combined. However, this assumption may be violated in the case where there are multiple tests from a single study, or multiple tests performed by one research group (Cooper, 1979; Strube, in press). The present authors recognize the possibility of this bias, but make the same assumption of independence of tests made by previous reviewers.

[6]We are indebted to Charles Turner for suggesting this possibility.

[7]Associates of Fiedler were defined as co-authors, students, and research associates.

Table 1

Original Studies used by Fiedler to Derive the Contingency Model

	Octant															
	I		II		III		IV		V		VI		VII		VIII	
Reference	r	p	r	p	r	p	r	p	r	p	r	p	r	p	r	p
Anderson & Fiedler (1962)					.10	.460							.20	.421		
					-.16	.562							.13	.448		
Cleven & Fiedler (1956)	2.00	.0228														
Fiedler (1954)			2.81	.00248												
			2.45	.00710												
			1.99	.0233												
Fiedler (1955)	1.94	.0265							.74	.231						
	.88	.188							.80	.212						
Fiedler, Bass, & Fiedler (1961)							1.06	.145							.48	.317
Fiedler, London, & Nemo (1961)							1.65	.0491							1.92	.0276
Fiedler, Meuwese, & Onk (1961)							1.83	.0330							1.92	.0276
															1.29	.0979
															.53	.297
Godfrey, Fiedler, & Hall (1959)	2.06	.0197					.58	.282	.63	.263					1.79	.0370
Havron et. al. (1951)	1.81	.0351														
Hutchins & Fiedler (1960)	.96	.169							1.42	.0775						
Mental Health Leadership Study (Fiedler, 1967)							.96	.169							1.69	.0365
Meuwese & Fiedler (1964)					.93	.176	.47	.321					.42	.338	.46	.323

Note: Results for multiple dependent measures in the same octant are averaged.

Table 2

Octant-bound Validation, Training, and Coacting Studies

	Octant															
	I		II		III		IV		V		VI		VII		VIII	
Reference	z	p	z	p	z	p	z	p	z	p	z	p	z	p	z	p
Bates (1967)[bd]	1.63	.0514							1.83	.0330						
Chemers, Rice, Sundstrom, & Butler (1975)[c]											4.42	4.9×10^{-6}			3.2?	6.87×10
Chemers & Skrzypek (1972)	.39	.350	.23	.408	-.05	.521	.26	.396	.26	.396	.07	.473	.04	.483	.23	.408
Fiedler (1966)	1.56	.0588	-.81	.791	.66	.255	.155	.438	.14	.444	.155	.438	-.01	.504	-.25	.599
Fiedler exec (Fiedler, 1967a)			-1.02	.846			1.58	.0567								
Fiedler & Hutchins (1967)[cd]	-1.75	.906							.62	.268						
Fiedler, O'Brian, & Ilgen (1969)			.69	.246			0	.500			1.91	.0282			1.67	.0471
Graen, Orris, & Alvares (1971)[a]	-.89	.813	.76	.223	-.87	.808	.60	.273	.53	.297	-.84	.800	.93	.176	-.70	.757
	.29	.387	-.41	.659	-.02	.510	-.17	.567	-1.28	.900	-1.04	.851	1.10	.136	-1.07	.858
Hardy (1971)[a]	2.55	.00534	-1.59	.944	2.72	.00331	2.05	.0204								
Hardy (1975)[a]									3.65	1.32×10^{-4}	3.65	1.32×10^{-4}	2.07	.0193	1.28	.101
Hardy, Sack, & Harpine (1973)[a]			-1.60	.945			2.46	.00686			2.83	.00235			1.68	.0461
Hill (1969)[bd]	.48	.314			.67	.250			1.28	.0996			2.33	.00991		
Hill (1969)[d]			.24	.405	.68	.247					-.61	.730	1.58	.0566		
Hovey (1974)[a]							-.87	.807							1.49	.0682
Hunt (1967)[bd]	.91	.181							1.50	.0670						
	.19	.425							1.52	.0643						
Hunt (1967)[d]	1.49	.0701			-1.17	.879			.62	.269			.41	.342		
	1.39	.0824			1.50	.0670							-.41	.658		
McNamara (1967)[bd]	1.49	.0594							.96	.168						
Mitchell (1969)			-.75	.773			1.55	.0606								
O'Brian, Fiedler, & Hewett (1969)[d]			1.01	.155			1.26	.104			-1.10	.864			.27	.393
Reilly (1968)[c]					-2.46	.99310										
Rice & Chemers (1973)											.76	.224			1.04	.149
Sashkin (1972)					.84	.201										
Sashkin, Taylor, & Tripathi (1974)[ad]					-.31	.622							.55	.291		
Schmier (1973)			3.88	5.47×10^{-5}												
Seifert (1969)[cd]	-2.10	.9821														
	-1.61	.9463			-1.61	.9463					-.67	.749				
Schifflet & Healy (1972)[a]					-.58	.719	.18	.429								

Table 2 (continued)

Octant-bound Validation, Training, and Coacting Studies

	Octant															
	I		II		III		IV		V		VI		VII		VIII	
Reference	$\bar{x}$	p	$\bar{x}$	p	$\bar{x}$	p	$\bar{x}$	p	$\bar{x}$	p	$\bar{x}$	p	$\bar{x}$	p	$\bar{x}$	p
Shima (1968)			.96	.168			3.20	6.87×10^{-4}								
Tunes (1972)[d]	2.84	.00226					3.84	6.15×10^{-5}								

Note: Results for multiple dependent measures in the same octant are averaged.

[a] not in Fiedler (1978)

[b] coacting groups

[c] training groups

[d] field study

Table 3

Extension Studies

	Situational Control					
	High		Moderate		Low	
Reference	$\bar{z}$	p	$\bar{z}$	p	$\bar{z}$	p
Anderson (1966)	1.24	.108	-.51	.695	-.26	.604
	-.48	.686				
Fiedler & Barron (1967)	1.14	.128	1.07	.142	.95	.171
	1.12	.132	-.175	.569	1.35	.0885
	-.42	.663	-.185	.573	-.045	.518
Geyer & Julian (1973)			.10	.460	1.89	.0294
Lawrence & Lorsch (1967)[a]	.95	.171	1.36	.0870		
	.14	.445				
	.22	.414				
Nealy & Blood (1968)[a]	.95	.171	2.40	.00820		
Nealy & Owen (1970)	2.58	.00494				
O'Brian (1969)	.29	.386	3.68	1.17×10^{-4}	.70	.242

Note: Results for multiple dependent measures in the same zone are averaged.

[a] Field study

Table 4

Meta-Analysis of the Studies Included in Fiedler's 1978 Review

	Octant								
	I	II	III	IV	V	VI	VII	VIII	Combined
Field Studies									
$\underline{N}$	3	3	3	3	1	3	3	2	21
$\underline{z}_s$	3.30	1.12	.58	2.94	.62	.12	.91	1.37	3.20
$\underline{p}$	4.83×10^{-4}	.131	.281	.00164	.268	.452	.181	.0853	6.87×10^{-4}
$\underline{N}_{fs}$	9	0	0	7	0	0	0	0	58
Laboratory Studies									
$\underline{N}$	2	6	3	5	2	3	2	3	26
$\underline{z}_s$	1.38	1.01	.84	3.02	.28	.57	.07	.59	2.95
$\underline{p}$	.0838	.156	.2005	.00126	.390	.284	.472	.278	.00159
$\underline{N}_{fs}$	0	0	0	12	0	0	0	0	58
Combined									
$\underline{N}$	5	9	6	8	3	6	5	5	47
$\underline{z}_s$	3.43	1.47	1.00	4.19	.59	.48	.72	1.32	4.84
$\underline{p}$	3.02×10^{-4}	.0708	.159	1.39×10^{-5}	.278	.316	.236	.0934	6.49×10^{-7}
$\underline{N}_{fs}$	17	0	0	44	0	0	0	0	360

Table 5

Meta-Analysis of Additional Studies not Included by Fiedler 1978

	Octant								
	I	II	III	IV	V	VI	VII	VIII	Combined
Field and Laboratory Studies									
$\underline{N}$	3	4	5	6	3	4	4	5	34
$\underline{z}_s$	1.13	-1.42	.42	1.74	1.67	2.30	2.32	1.20	3.28
$\underline{p}$	.129	.9222	.327	.0409	.0475	.0107	.0102	.115	5.19×10^{-4}
$\underline{N}_{fs}$	0	0	0	1	0	4	4	0	101
Additional Studies and Fiedler 1978 Studies									
$\underline{N}$	8	13	11	14	6	10	9	10	81
$\underline{z}_s$	3.40	.44	1.02	4.30	1.60	1.83	2.09	1.78	5.81
$\underline{p}$	3.37×10^{-4}	.330	1.54	8.50×10^{-6}	.0548	.0336	.0183	.0375	3.10×10^{-9}
$\underline{N}_{fs}$	26	0	0	82	0	2	6	2	929

Table 6

Meta-Analysis of Studies Examining Training and Coacting Groups

	Octant								
	I	II	III	IV	V	VI	VII	VIII	Combined
Training and Co-acting Studies									
$\underline{N}$	8	0	3	0	6	2	1	1	21
$\underline{Z}_s$	-.27	-	-1.96	-	3.15	2.65	2.33	3.20	2.80
$\underline{p}$	.606	-	.975	-	8.16×10^{-4}	.00402	.00990	6.87×10^{-4}	.00256
$\underline{N}_{fs}$	0	-	0	-	16	3	1	3	40

Table 7

Meta-Analysis of all Octant-bound Studies

	Octant								
	I	II	III	IV	V	VI	VII	VIII	Combined
$\underline{N}$	16	13	14	14	12	12	10	11	102
$\underline{Z}_s$	2.21	.44	0	4.30	3.36	2.75	2.72	2.67	6.45
$\underline{p}$	.0136	.330	.5	8.50×10^{-6}	3.90×10^{-4}	.00298	.00326	.00379	5.59×10^{-11}
$\underline{N}_{fs}$	13	0	0	82	38	22	17	18	1466

Table 8

Meta-Analysis of Extension Studies

	Situational Control Zone			
	High	Moderate	Low	Combined
N	11	8	6	25
z_s	2.33	2.74	1.87	4.01
p	.00990	.00307	.0307	3.04×10^{-5}
N_{fs}	11	14	2	124